

Refrigeration – getting the most bang for your bucks

As can be seen from the chart below, Simplex refrigeration with one compressor per cabinet / evaporator is the most energy inefficient refrigeration plant available. The strongest case for it today is where one is far away from higher skilled refrigeration technicians.

MiniPlex plant is designed to bring efficiencies to small stores with up to five evaporators or 30Kw of refrigeration. A typical application would be in garage forecourt stores.

While it is hard to pin-point, in general terms, CO₂ appears to have superior power efficiency when compared to equivalent output high tech HFC MultiPlex plants.

In terms of CO₂ power efficiency compared to HFC's we have been quoted everything from 'the same as' to 15 – 25% more efficient as well as 30 – 60% more efficient. These are huge differentials that need to be investigated. CO₂ also has the advantages of bragging rights for the environment, an increasingly relative lower cost for CO₂ gas compared to HFC's. CO₂ plants also occupy about a quarter of the plant room space that equivalent output MultiPlex plants occupy.

A newer arrival on the market are self-contained cabinets fitted with variable speed compressors and a water loop to take the heat they generate out of the



store. This is claimed the most power efficient refrigeration system. There are a number of other associated benefits. It offers the most stable cabinet temperatures with users claiming up to four days more shelf life in fresh meat as a result. With less than 1.8m of copper tubing and 3 kg of gas per cabinet there is little chance of a gas leak and little gas to lose if there is one .

Refrigeration plant efficiency

Type of plant	Approx. energy consumption index
Simplex	100
MiniPlex (supports up to 5 evaporators)	85
MultiPlex	75
CO ₂	60
Self-contained water loop + variable speed compressors	60

How to improve cabinet efficiency

- Fit glass doors on vertical upright cabinets, or install night blinds
- Install LED lights
- Install high performance coils & EC fans
- Install electronic expansion valves

With all the above installed, cabinets are about 50% more energy efficient than without. There is approximately a 20% greater cabinet capital cost involved. When installed in a new store, the lower energy requirement leads to a smaller refrigeration plant size requirement which will cost less.

All in all, retrofitting the above will produce a payback for the extra investment in about two years.



It should be noted that sliding tops, unlike glass doors on upright cabinets, do not contribute much to island cabinet efficiency. The benefit is mostly psychological as the cold air hardly spills out of open island cabinets.

Insulation is a key factor in cold and freezer room efficiency. The introduction of polyurethane insulation panels has improved thermal efficiency, compared to polystyrene panels as they absorb water which reduces their efficiency.

There is also a trend to thicker panels for better insulation. This has become more important with load shedding and grid failures. Refrigerated rooms must hold their temperature as long as possible in the event of a power failure.

Refrigeration efficiency & your electricity bill

The general rule is to install the most energy-efficient refrigeration plant and cabinets you can afford. An often ignored benefit of this is that you can reduce the size and with it the cost of the standby generator you install. Another benefit is the reduction in cost of generating that electricity which can cost 10 times more than Eskom charges.

However what you'll pay to power your refrigeration is also very much tied to your electricity provider's tariff structure and charges.

As noted in a previous *Energy Savvy* article, the two main components of one's electricity bill is a maximum demand charge and a time of use charge. The structure and charges vary widely from municipality to municipality, while Eskom charges are standardised nation-wide. The maximum demand charge can account for as much as 50% of the total bill, while the highest time of use charge can be as much as eight times higher than the lowest.

Celebrating 40 years of Quality and Energy Efficiency



2019 marks the 40th anniversary of **Staycold International**, a market leading company founded in 1979 by Koos Badenhorst and Johan Roets who identified the requirement in the farming community for effective and efficient cold storage during periods of limited electricity supply.

The Staycold brand came into existence when the Safari, Panorama and City ranges were developed to operate on 1 hours' worth of generator power per day and keep items refrigerated for up to 48 hours.

The company evolved from a small-scale manufacturer to what is today, a customer centric company with an international presence and well known amongst the leading brands for exactly its founding purpose – cold storage solutions built on the principles of quality, durability, performance, efficiency and reliability. Such solutions being available in a range of upright hinged and sliding door coolers and freezers.

During 2011, Staycold became part of the Universal Industries Corporation, an industrial holding company for South Africa's leading suppliers of commercial refrigeration equipment, bakery equipment and catering equipment.



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Raising Standards Reducing Costs

*figure based on energy consumption of a HD1140-LF compared to a competitor unit that consumes 11kWh/24hr





With refrigeration as the single biggest user of electricity in the store, it makes sense that the specs for the refrigeration and the settings used takes your local electricity charge structure into account.

On the maximum demand side, it is important that the refrigeration plant is set up for soft and staggered start-ups of equipment, and staggered defrost cycles that avoid heavy spikes in maximum demand and peak time of use charges

which usually run 6am – 9am in the morning to 6pm – 9pm in the evening. Without this, collective starts of electric equipment such as motors, ovens and heaters will cause a huge surge in the amount of electric current used and spike in the maximum demand reading. It is the highest demand reading in any one thirty minute period during the month that sets the maximum demand charge for every thirty minute period in the month.

One of the biggest culprits, sending store electricity bills into the stratosphere, is the maximum demand charge spiking on restarting store equipment after load shedding and other power failures. If your refrigeration plant is not set up to avoid spikes in demand when power is restored, expect a hefty electricity bill.

Relative costs – Most to least expensive (1–5)

Capital cost	Running cost electricity	Maintenance cost – gas, servicing & repairs
(1) CO ₂	(1) SimPlex	(1) SimPlex
(2) Water Loop MultiPlex MiniPlex	(2) MiniPlex	(2) MultiPlex
	(3) MultiPlex	(3) CO ₂
	(4) CO ₂	(4) MiniPlex
(3) SimPlex	Water Loop	(5) Water Loop

Note: CO₂ was not recommended between the tropics of Cancer and Capricorn because of the high ambient temperatures – however improved CO₂ technology has largely eliminated this problem.

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